

DROSOPHILA HEDGEHOG  
CHICKEN HEDGEHOG-A  
CHICKEN HEDGEHOG-B

1 - - - - - S V P H A S A A S V T C L S L D A K C H S S S S S S S K S A A S S I CHICKEN SONIC HEDGEKOG  
1 H D H H S S V P H A S A A S V T C L S L D A K C H S S S S S S S K S A A S S I DROSOPHILA HEDGEKOG

1 - - - - - H V E H L L L T R I L L V G F I C A L L V S CHICKEN SONIC HEDGEKOG  
41 S A I P Q E E T Q T H R H I A H T Q R C L S R L T S L V A L L L I V L P H V F S DROSOPHILA HEDGEKOG

23 S G L T C G P G R G I G K R R H P K K L T P L A Y K Q F I P H V A E K T L G A S CHICKEN SONIC HEDGEKOG  
81 F A H S C G P G R G L G R H R - A R H L Y P L V L K Q T I P H L S E Y T H S A S DROSOPHILA HEDGEKOG

63 G R Y E C K I T R N S E R P K E L T P H Y N P D I I F K D E E N T G A D R L H T CHICKEN SONIC HEDGEKOG  
120 G P L E G V T R R D S P K F K D L V P H Y N R D I L F R D P P C T G A D R L H S DROSOPHILA HEDGEKOG

103 Q R C K D K L H A L A I S V H N Q H P G V K L R V T E G H D E D C H H S E E S L CHICKEN SONIC HEDGEKOG  
160 K R C K E K L H V L A Y S V H N E H P G I R L L Y T E S H D E D Y H H C Q E S L DROSOPHILA HEDGEKOG

143 H Y E G R A V D I T T S D R D R S K Y O H L A R L A V E A Q P D H V Y Y E S K A CHICKEN SONIC HEDGEKOG  
200 H Y E G R A V T I A T S D R D Q S K Y G H L A R L A V E A G P D H V S Y V S R R DROSOPHILA HEDGEKOG

183 H I H C S V R A E H S V A A K S G Q C F P O S A T V H L E H Q O T K L V K D L S CHICKEN SONIC HEDGEKOG  
240 J L I Y G S V K S D S S I S S H V H Q C F T P E S T A L L E S G V R K P L O E L S DROSOPHILA HEDGEKOG

223 F G D R V L A A D A D G R L L Y S D F L T F L D R H D S S R K L F Y V I E T R Q CHICKEN SONIC HEDGEKOG  
200 I G D R V L S H T A H G Q A V Y S E V I L E H D R H L E Q H Q N F V O L H T - D DROSOPHILA HEDGEKOG

263 P R A R I L L T A A H L L F V A P Q H N Q S E A T O S T S Q Q A L F A S H V K P CHICKEN SONIC HEDGEKOG  
319 O G A V L T V T F A H L L V S V H Q - - - - - P E S Q K L T F V F A D R I E E DROSOPHILA HEDGEKOG

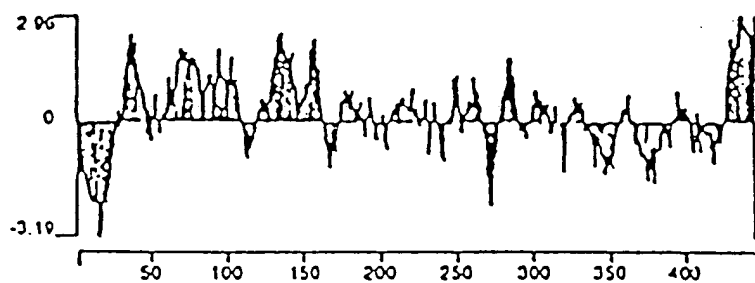
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352 K H O V L V R D V E T O E L R P Q R V V K V G - S V R S K G V V A P L T R E G T DROSOPHILA HEDGEKOG

343 I L I H R V L A S C Y A V I E E H S H A H H A F A P F R L A O G L - - - L A A - CHICKEN SONIC HEDGEKOG  
391 I V V H S V A A S C Y A V I N S Q S L A H H O L A P H R L L S T L E A H L P A K DROSOPHILA HEDGEKOG

379 - - L C P D G A I P T A A T T T T O I H H Y S R L L Y R I G S H V L D O D A L H CHICKEN SONIC HEDGEKOG  
431 E O L H S S P K V V S S A Q Q Q H Q I H H Y A H A L Y K V K D Y V I P Q S H R H DROSOPHILA HEDGEKOG

417 P L G H V A P A S  
471 D CHICKEN SONIC HEDGEKOG  
DROSOPHILA HEDGEKOG

FIGURE 2



HYDROPATHY INDEX

FIGURE 3

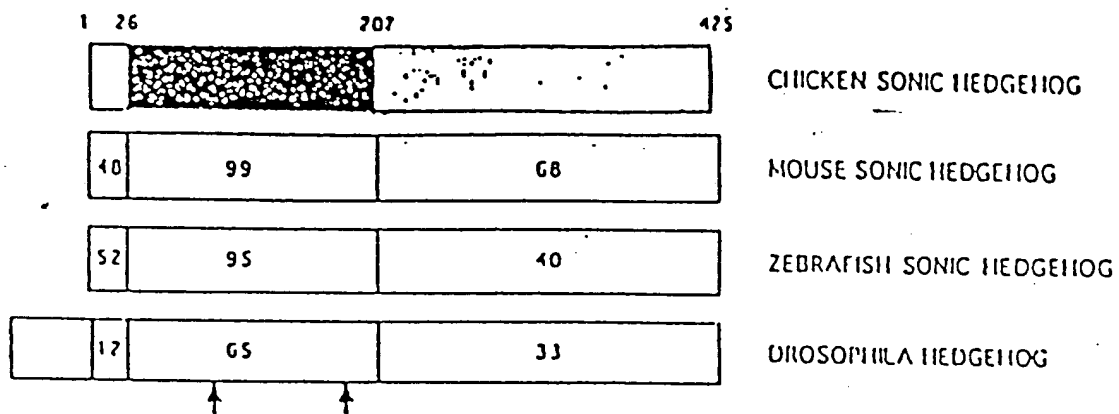


FIGURE 4

U-hh	MDNHSSVPWA	SAASVTCLSL	DAKCHSSSSS	SSSKSAASSI	SAIPOEETQT
M-Dhh	.....	.....	.....	.....	.....
M-Ihh	.....	.....	.....	.....	.....
M-Shh	.....	.....	.....	.....	.....
C-Shh	.....	.....	.....	.....	.....
Z-Shh	.....	.....	.....	.....	.....
51					
D-hh	MRHIAHTQRC	LSRLTSLVAL	LLIVLPHVFS	PAHSCGPGRG	LGRHR...AR
M-Dhh	.....	..MALPASLL	PLCCLALLAL	SAQSCGPGRG	PVGRRRYVRK
M-Ihh	.....	.....	.....	.....	.....
M-Shh	.....	MLLLLARCFL	VILASSLLVC	PGLACGPGRG	FGKRRH...PK
C-Shh	.....MV	EMLLLTRILL	VGFIGALLVS	SGLTCGPGRG	IGKRRH...PK
Z-Shh	.....	..MRLLTRVLL	VSLTSLV	SGLACGPGRG	YGRRRH...PK
101					
D-hh	NLYPLVLKQT	IPNLSEYTN	ASGLEGVIR	RDSKPKDLV	PNYNRDILFR
M-Dhh	QLVPLLYKQF	VPSMPERTLG	ASCPAEGRVT	RGSERFRDLV	PNYNPDIIFK
M-Ihh	.....	.....	.....	...ERPKELT	PNYNPDIIFK
M-Shh	KLTPLAYKQF	IPNVAEKTG	ASGRYEGKIT	RNSERFKELT	PNYNPDIIFK
C-Shh	KLTPLAYKQF	IPNVAEKTG	ASGRYEGKIT	RNSERFKELT	PNYNPDIIFK
Z-Shh	KLTPLAYKQF	IPNVAEKTG	ASGRYEGKIT	RNSERFKELT	PNYNPDIIFK
151					
D-hh	DEEGTGADRL	MSKRCKEKLN	VLAYSVMNEW	PGIRLLVTE	WDEDYHGGQE
M-Dhh	DEENSGADRL	MTQCKKRVN	ALAIAMVNMW	PGVRLRVTE	WDEDGHHQAD
M-Ihh	DEENTGADRL	MTQCKKRLN	SLAISVMNQW	PGVRLRVTE	WDEDGHHQAD
M-Shh	DEENTGADRL	MTQCKKRLN	ALAISVMNQW	PGVRLRVTE	WDEDGHHQAD
C-Shh	DEENTGADRL	MTQCKKRLN	ALAISVMNQW	PGVRLRVTE	WDEDGHHQAD
Z-Shh	DEENTGADRL	MTQCKKRLN	SLAISVMNQW	PGVRLRVTE	WDEDGHHQAD
201					
D-hh	SLHYEGRAVT	IATSDRDSK	YGLARLAVE	AGFDWVSYS	RRHIYCSVKS
M-Dhh	SLHYEGRAVD	ITTSDRDRNK	YGLARLAVE	AGFDWVSYS	RNIHVSVKA
M-Ihh	SLHYEGRAVD	ITTSDRDRNK	YGLARLAVE	AGFDWVSYS	KAHVCSVKA
M-Shh	SLHYEGRAVD	ITTSDRDRSK	YGLARLAVE	AGFDWVSYS	KAHVCSVKA
C-Shh	SLHYEGRAVD	ITTSDRDRSK	YGLARLAVE	AGFDWVSYS	KAHVCSVKA
Z-Shh	SLHYEGRAVD	ITTSDRDRSK	YGLARLAVE	AGFDWVSYS	KAHVCSVKA
251					
D-hh	DSSISSHVHG	CFTPESTALL	ESGVRKPLGE	LSIGDRVLMS	TANGQAVYSE
M-Dhh	DNSLAVRAGG	CFPGNATVRL	RSGERKGLRE	LHRGDWVLA	DAAGRVVPTP
M-Ihh	EHSAAAKTGG	CFPAGAQVRL	ENGERSALSA	VKPGDRVLAM	GEDGTPTFS
M-Shh	ENSVAAKSGG	CFPGSATVHL	EQCGTKLVKD	LRPGDRVLAA	DDQGRLLYSD
C-Shh	ENSVAAKSGG	CFPGSATVHL	EHGGTKLVKD	LSPGDRVLAA	DADGRLLYSD
Z-Shh	ENSVAAKSGG	CFPGSALVSL	QDGGQKAVKD	LNPGDKVLAA	DSAGNLVFS
301					
D-hh	VILFMDRNL	QMNFVQLHT	DGGAVLTVT	PAHLVSVWQ	.....PESQ
M-Dhh	VLLFLDRDLQ	RRASFVAVET	ERPPRKLTL	PWHLVFAAR	...GPAPAPG
M-Ihh	VLIFLDREPN	RLRAFQVIET	QDPPRLALT	PAHLFIADN	HTE...PAA
M-Shh	FLTFLDRDEG	AKKVFYVIET	LEPRERLTL	AAHLFVAP	HNDSGPTFGP
C-Shh	FLTFLDRMDS	SRKLFYVIET	RQPRARLLT	AAHLFVAPQ	HNOSEATGST
Z-Shh	FIMPTDRDST	TRRVFYVIET	QEPVEKITLT	AAHLFVLDN	STEDLHTMT
351					
D-hh	KLTFVFADRI	EEKNOVLV..	RDVETGELRP	QRVVKVGV.SV	RSKGVVAPLT
M-Dhh	DFAPVFARRL	RAGDSVLA..	..PGGDALQP	ARVARVA.RE	EAVGVFAPLT
M-Ihh	HFRATFASHV	QPGQYVLV..	..SGVPGLOP	ARVAVS.TH	VALGSAFPLT
M-Shh	S...ALFASRV	RPGQRYVVA	ERGDDRLLP	AAVHSVTLRE	EEAGAYAPLT
C-Shh	SGQALFASNV	KPGQRYVVLG	E...GGQQLLP	ASVHSVSLRE	EASGAYAPLT
Z-Shh	...AAYASSV	RAGQKVHVVD	DSGQLKSIV	QRIYT...E	EQRSFAPVT
401					
D-hh	REGTIVVNSV	AASCYAVINS	QSLAHWGLAP	MRLSTLEAW	LPAKEQLHSS
M-Dhh	ANGTLLVNDV	LASCYAVLES	HQWAHRAFAP	LRLHALGAL	LP.....
M-Ihh	RHGTLLVEDV	VASCFAAVAD	HHLAQALFAP	LRLFPSL...	.....
M-Shh	ANGTILINRV	LASCYAVIEE	HSWAHRAFAP	FRLAHALLAA	LAPARTDGGG
C-Shh	AQGTILINRV	LASCYAVIEE	HSWAHRAFAP	FRLAQGLLAA	LCP.....
Z-Shh	ANGTIVVDRI	LASCYAVIED	QGLAHAFAP	ARLYYVSSF	LSP.....
451					
D-hh	PKVV.....	...SSAQOQN	GIHWYANALY	KVKDYVLPQS	WRHD*
M-Dhh	.....	...GGAVOPT	GMHWYSRLLY	RLAEELMG*	.....
M-Ihh	.....	...ANGSWTFSE	GVHSYPOMLY	RLGRLLEES	TFHPLMGSGA
M-Shh	GGIPAAQSA	TEARGAEPTA	GIHWYSQLLY	HIGTWLDS	RSHPLGMAVK
C-Shh	DGAIPTA...	...ATTIT	GIHWYSRLLY	RIGSWVLDGD	ALHPLGMVAP
Z-Shh	KTPAVGPMRL	YNRRGSTGTP	GSC.....H	QMGTWLDSN	MLHPLGMSVN
501					
M-Ihh	GS*	.....	.....	.....	.....
M-Shh	SS*	.....	.....	.....	.....
C-Shh	AS*	.....	.....	.....	.....
Z-Shh	SS*	.....	.....	.....	.....

FIGURE 5A

Figure 5B

M-Dhh: CGPGRGPVGRRRRYVRRKQLVPLLYKQFVPSMPERTLGASGPAEGRVTTRGSSERFRDLV  
M-Ihh: \*\*\*\*\*  
H-Ihh: \*\*\*\*\*  
H-Shh: CGPGRGFGKRRH\*\*\*\*\*  
C-Shh: CGPGRGFGKRRH\*\*\*\*\*  
M-Shh: CGPGRGFGKRRH\*\*\*\*\*  
Z-Shh: CGPGRGFGKRRH\*\*\*\*\*  
CON: CGPGRGX

PNYNPD I I F K D E E N S G A D R L M T E R C K E R V N A L A I A V M N M W P G V R L R V T E G W D E D G H  
PNYNPD I I F K D E E N T G A D R L M T Q R C K D R L N S L A I S V M N Q W P G V R L R V T E G W D E D G H  
\* \* \* \* \*  
PNYNPD I I F K D E E N T G A D R L M T Q R C K D R L N S L A I S V M N Q W P G V R L R V T E G W D E D G H  
PNYNPD I I F K D E E N T G A D R L M T Q R C K D R L N S L A I S V M N Q W P G V R L R V T E G W D E D G H  
PNYNPD I I F K D E E N T G A D R L M T Q R C K D R L N S L A I S V M N Q W P G V R L R V T E G W D E D G H  
PNYNPD I I F K D E E N T G A D R L M T Q R C K D R L N S L A I S V M N Q W P G V R L R V T E G W D E D G H  
PNYNPD I I F K D E E N X G A D R L M T X R C K X X N X L A I S V M N X W P G V R L R V T E G W D E D G H

H A Q D S S L H Y E G R A L D I T T S D R D R N K Y G L L A R L A V E A G F D W V Y Y E S R N H I H V S V K A D  
H S E E S S L H Y E G R A V D I T T S D R D R N K Y G L L A R L A V E A G F D W V Y Y E S K A H V H C S V K S E  
H S E E S S L H Y E G R A V D I T T S D R D R N K Y G L L A R L A V E A G F D W V Y Y E S K A H V H C S V K S E  
H S E E S S L H Y E G R A V D I T T S D R D R N K Y G L L A R L A V E A G F D W V Y Y E S K A H I H C S V K A E  
H S E E S S L H Y E G R A V D I T T S D R D R N K Y G L L A R L A V E A G F D W V Y Y E S K A H I H C S V K A E  
H F E E S S L H Y E G R A V D I T T S D R D R N K Y G L L A R L A V E A G F D W V Y Y E S K A H I H C S V K A E  
H X X S S L H Y E G R A X D I T T S D R D R N K Y G L L A R L A V E A G F D W V Y Y E S X X H X X S V K X X

	M-Dhh	M-Ihh	C-Shh	Zf-Shh	D-hh
M-Shh	61 (77)	63 (78)	84 (92)	68 (80)	48 (64)
M-Dhh		58 (75)	61 (77)	54 (71)	51 (68)
M-Ihh			64 (78)	61 (75)	48 (68)
C-Shh				68 (80)	49 (64)
Zf-Shh					47 (64)

FIGURE 6

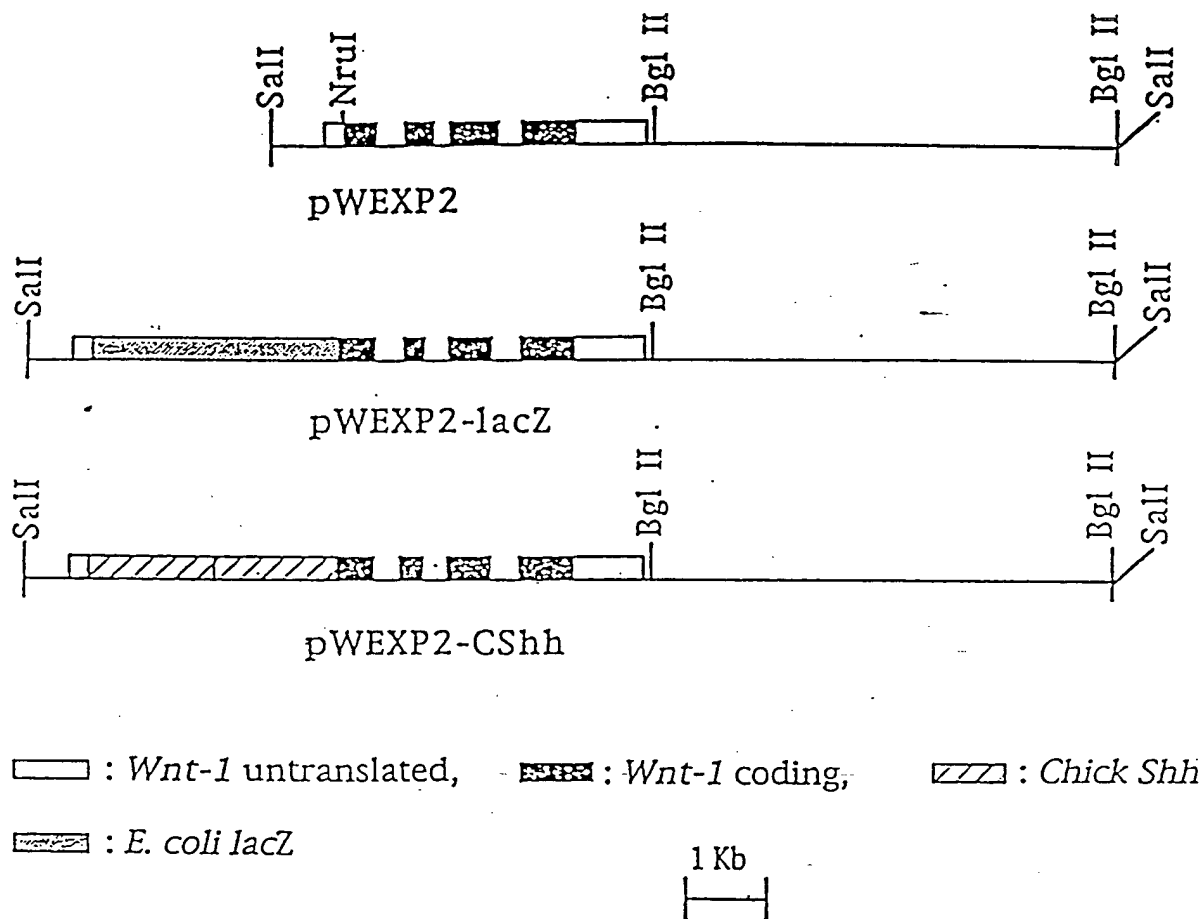


FIGURE 7



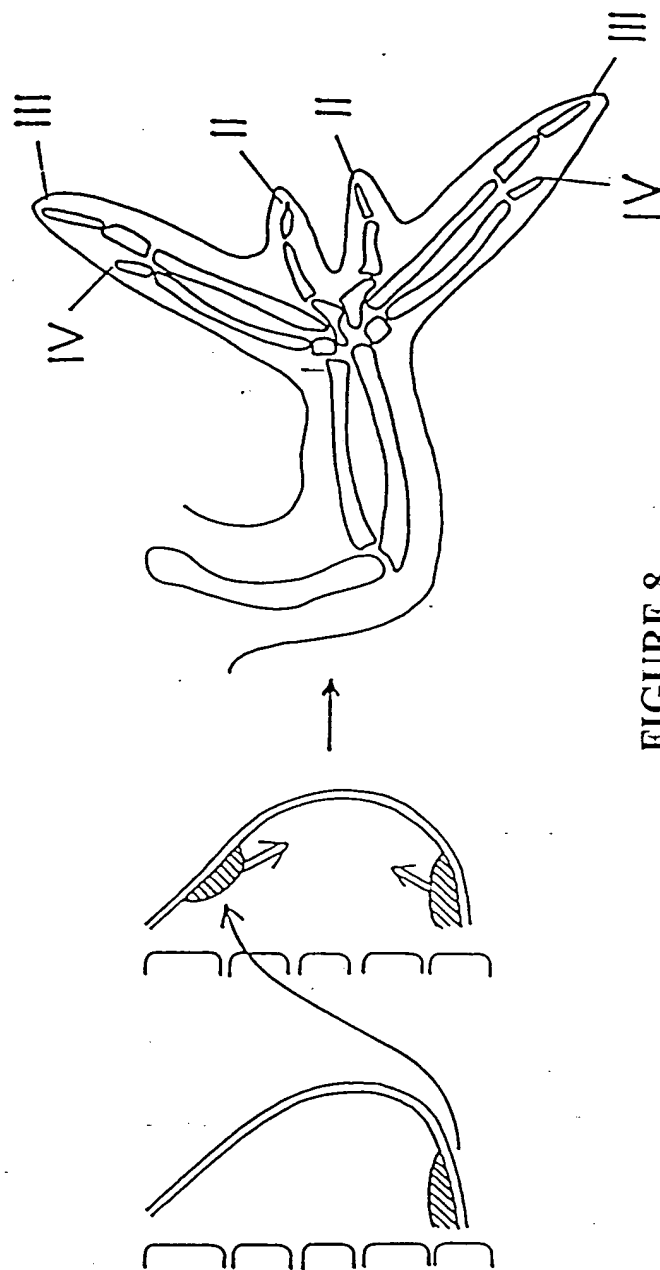
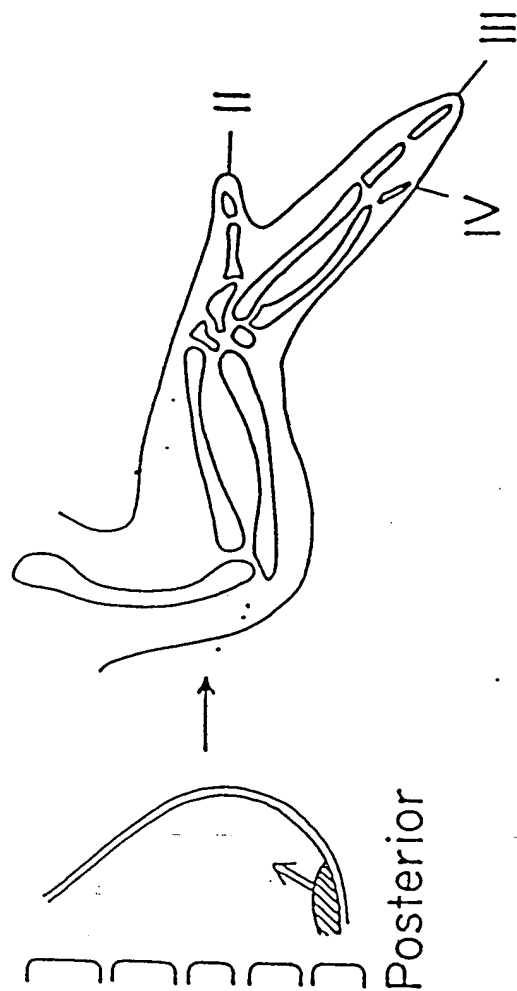


FIGURE 8

hh 1 MDNHSSVPWASAASVTCLSLDAKCHSSSSSSSSSKSAASSISAIPQEETQT

shh .....

hh 51 MRHIAHTQRCLSR<sup>Y</sup>LTSLVALLLIVLPMVFSPAHS<sup>Y</sup>CGPGRGLGRHR.ARNL  
 || | | | | | | | | | |

shh 1 .....MRL<sup>Y</sup>LTRVLLVSL<sup>Y</sup>LTSLVVS.GLACGPGRGYGRRRHPKKL

hh 100 YPLVLKQTIPNLSEYTNSASGPLEGVIRRDSPKFKDLVPNYNRDILFRDE  
 || || || | | || | | | | | | | | | | |

shh 40 TPLAYKQFIPNVAEKT<sup>Y</sup>LGASGRYEGKITRNSERFKELTPNYNPDIIFKDE

hh 150 EGTGADRLMSKRCKEKLNVLA<sup>Y</sup>YSVMNEWPGIRLVV<sup>Y</sup>TESWDEDYHHGQESL  
 | | | | | | | | | | | | | | | | | | | |

shh 90 ENTGADRLMTQRCKDKLNSLAISVMNHWP<sup>Y</sup>GVKLRVTEGWDEDGHHFEESL

hh 200 HYEGR<sup>Y</sup>AVTIATSDRDQSKYGMLARLAVEAGFDWVS<sup>Y</sup>YVSRRIYCSVKSDS  
 | | | | | | | | | | | | | | | | | | | |

shh 140 HYEGR<sup>Y</sup>AVDITTSRDQSKYGTLSRLAVEAGFDWVYYESKAHIHCSVKAEN

hh 250 SISSHVHGCFTPESTALLES<sup>Y</sup>GVKPLGELSIGDRVLSMTANGQAVYSEVI  
 | | | | | | | | | | | | | | | | | |

shh 190 SVAAKSGGCFPGSALVSLQDGGQKAVKDLNPGDKVLAADSAGNLVFSDFI

hh 300 LFM<sup>Y</sup>DRNLEQM<sup>Y</sup>QNFVQLHT.DGGAVLT<sup>Y</sup>VT<sup>Y</sup>PAHLVSVWQPESQKL...TFVF  
 | | | | | | | | | | | | | | | | |

shh 240 MFTDRDSTTRRVFYVIETQEPVEKITLTA<sup>Y</sup>AHL<sup>Y</sup>LFVLDNSTEDLHTMTAAY

hh 347 ADRIEKNQVLVRDVETGELRPQRVVKVGSVRSKGVVAPLTREGTIVVNS  
 | | | | | | | | | | | | | | | | |

shh 290 ASSVRAGQKVMVVD.DSGQLKSVIVQRIYTEEQRGSFAPVTAHGTIVVDR

hh 397 VAASCYAVINSQSLAHWGLAPMRL<sup>Y</sup>STLEAWLPAKEQL.....HSS  
 | | | | | | | | | | | | | | | | |

shh 339 ILASCYAVIEDQGLAHLAFAPARLYYVSSFLSPKTPAVGPMRLYNRRGS

hh 438 PKVVSSAQQQNGIHWYANALYKVKDYVLPQSWRHD 471  
 | | | | | | | | | |

shh 389 TGTPGSCHQMGTWLLDSNMLHPLGMSV..... 415

FIGURE 9A

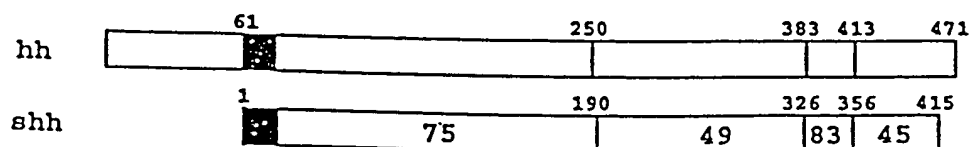


FIGURE 9B

hh  
shh  
hh [a]  
hh [b]

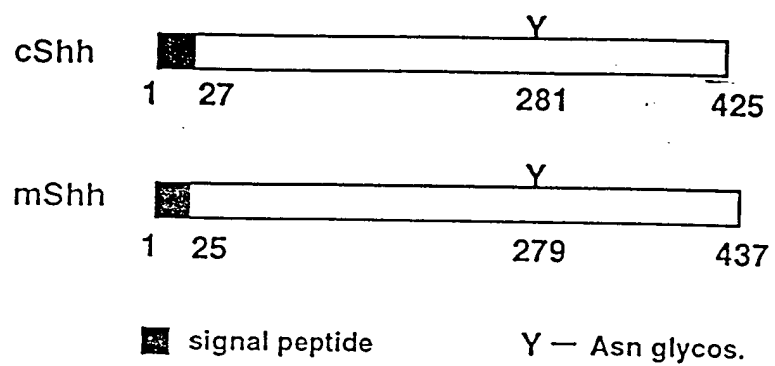


FIGURE 11

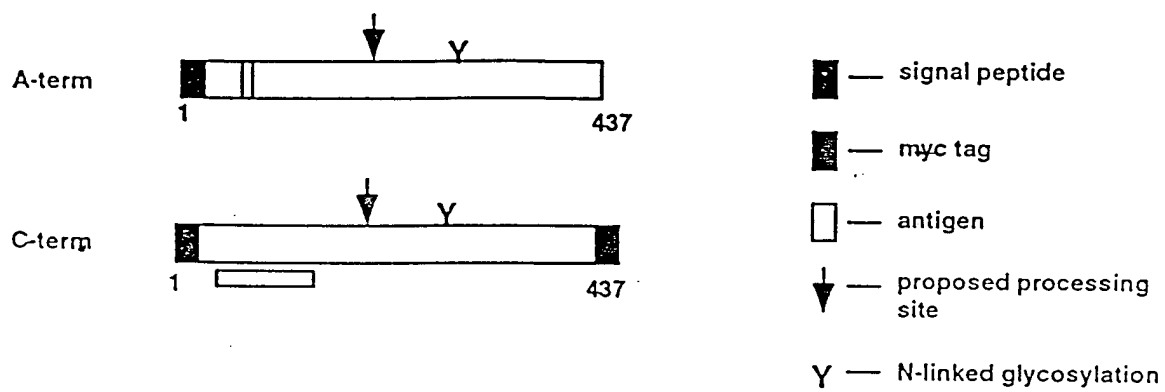


FIGURE 12

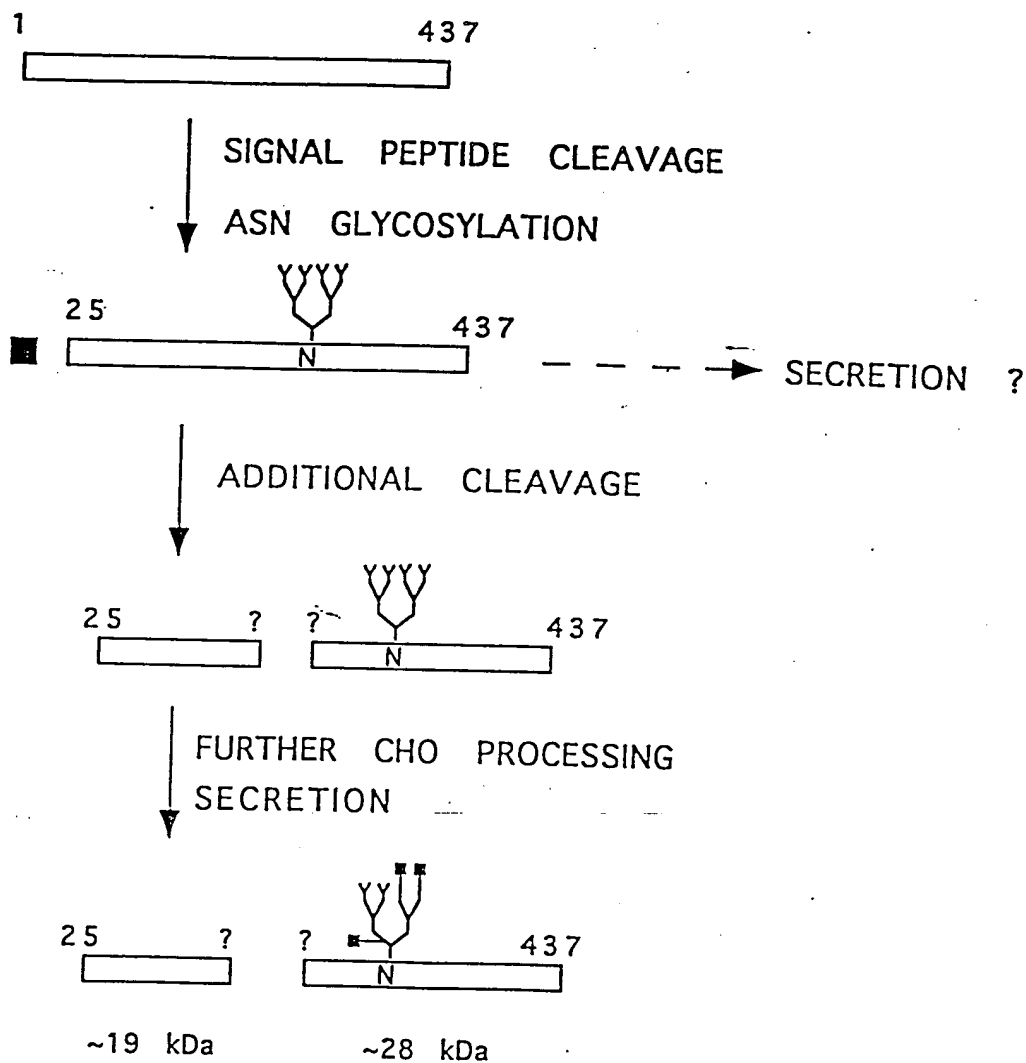


FIGURE 13

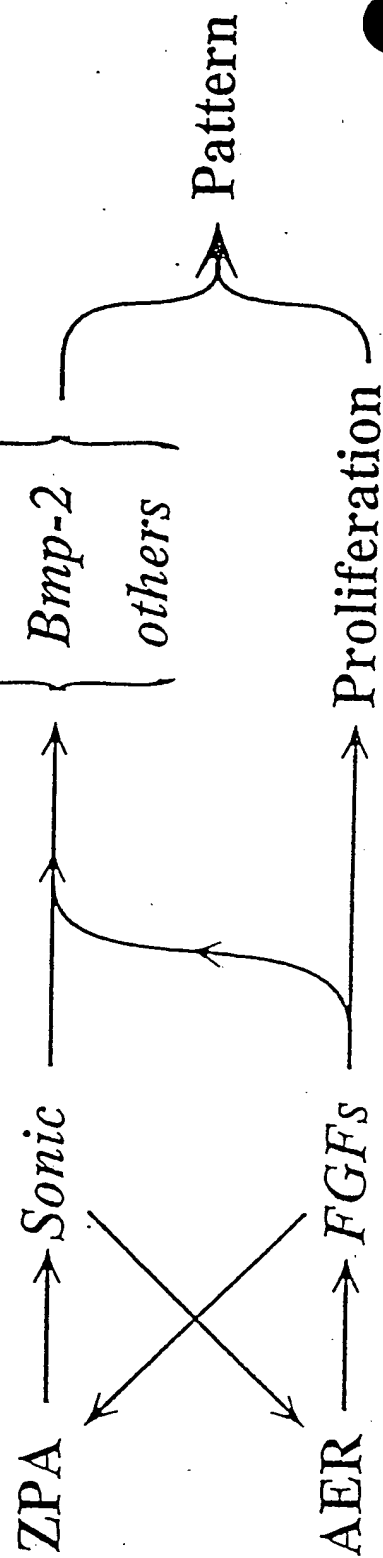


FIGURE 14

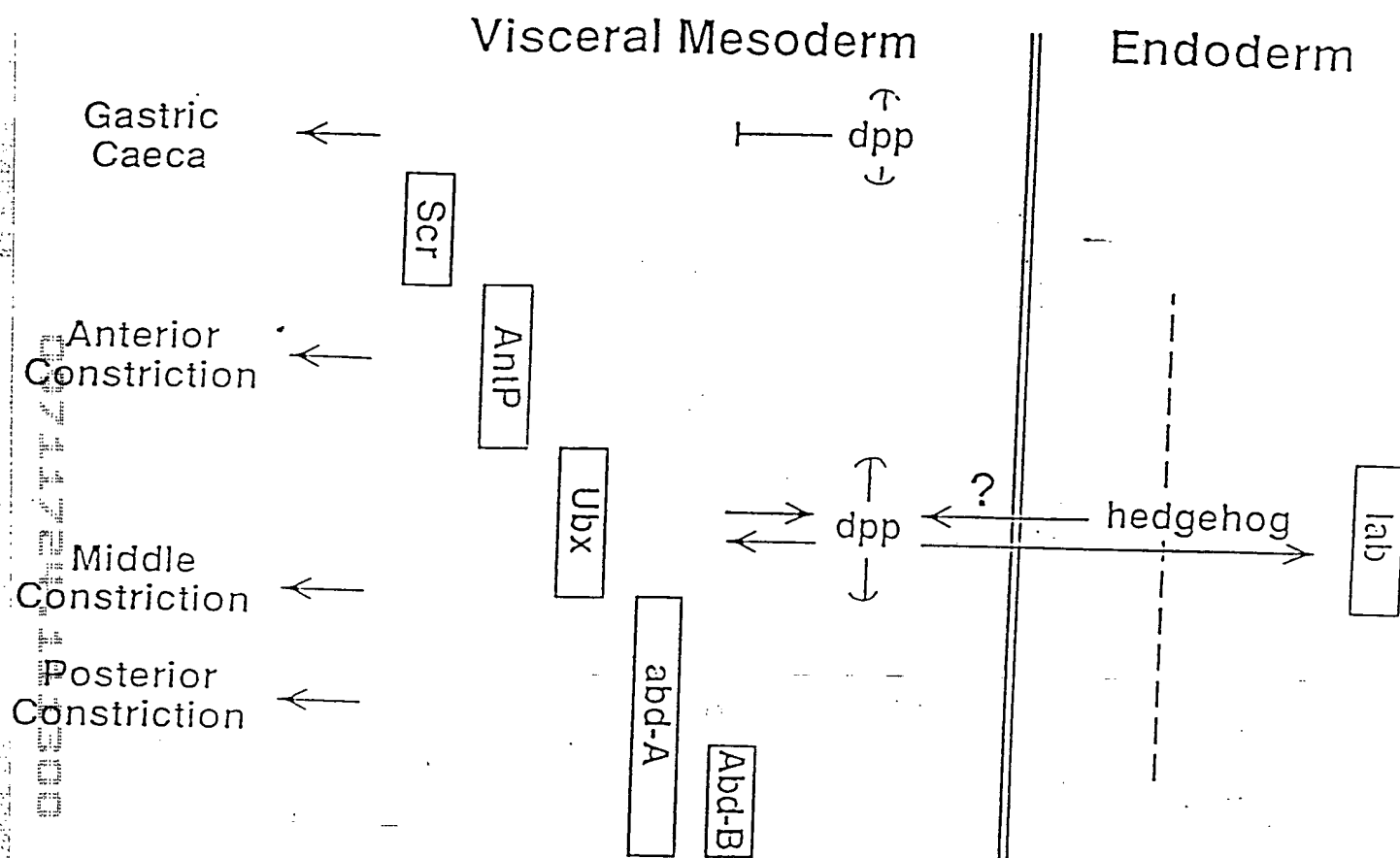


FIGURE 15A





	<i>Pdgfr</i>	<i>Gdc1</i>	<i>Ras</i>	<i>Dna</i>	
1	■	■	■	■	0
2	■	■	■	■	0
3	■	■	■	■	0
4	■	■	■	■	0
5	■	■	■	■	5
6	■	■	■	■	14
7	■	■	■	■	63
8	■	■	■	■	50

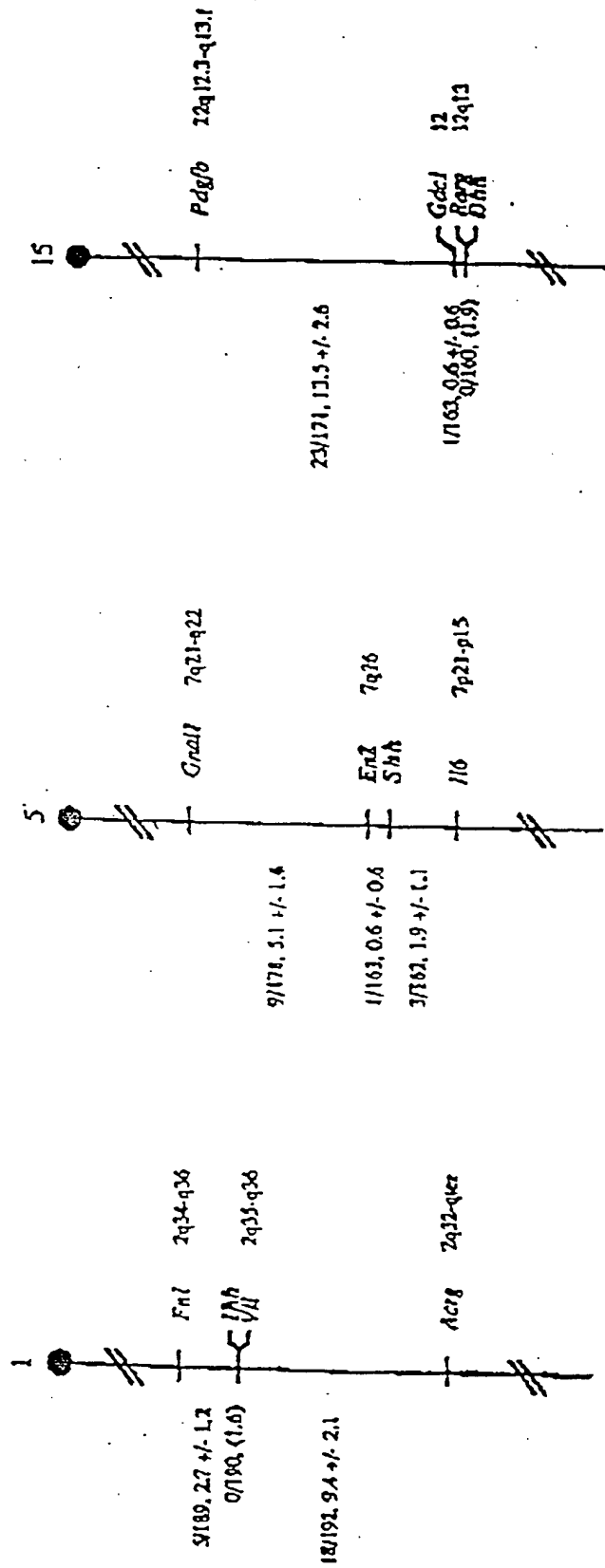


FIGURE 16

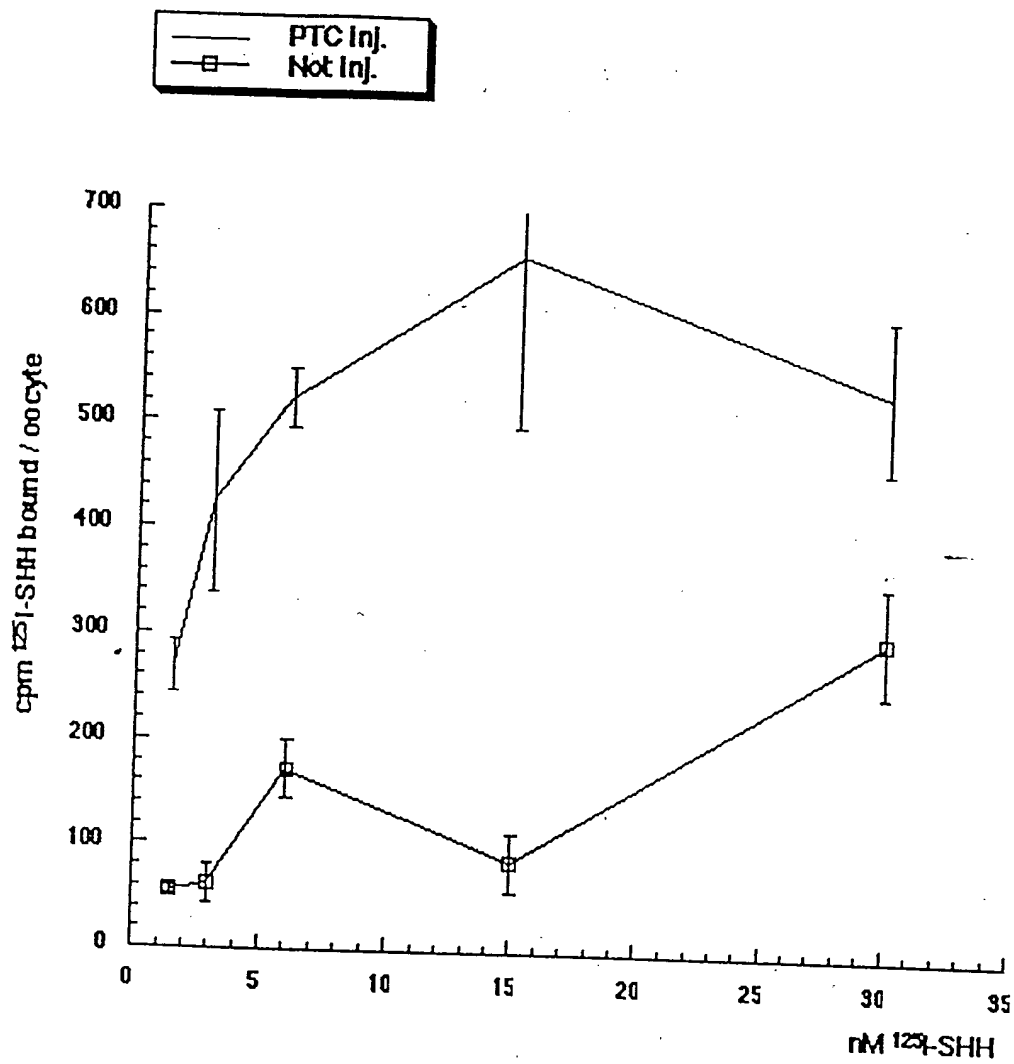


FIGURE 17

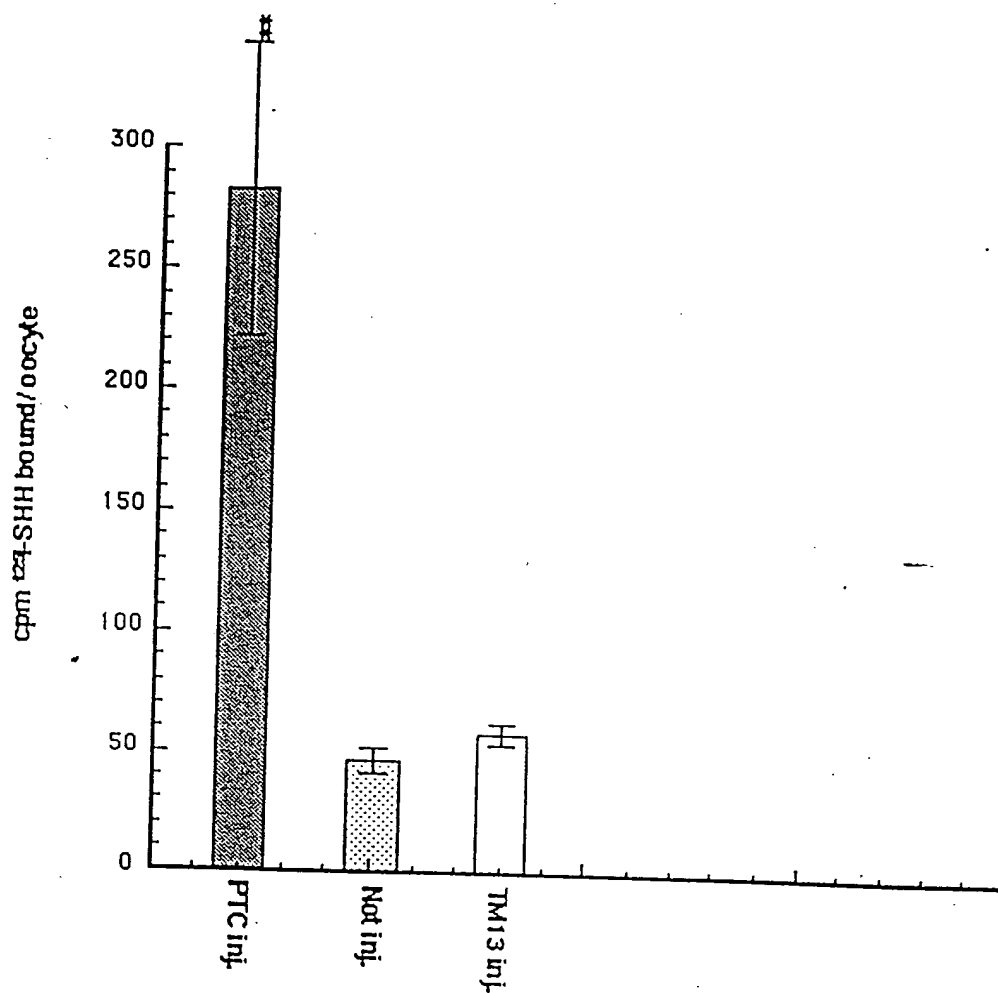


FIGURE 18

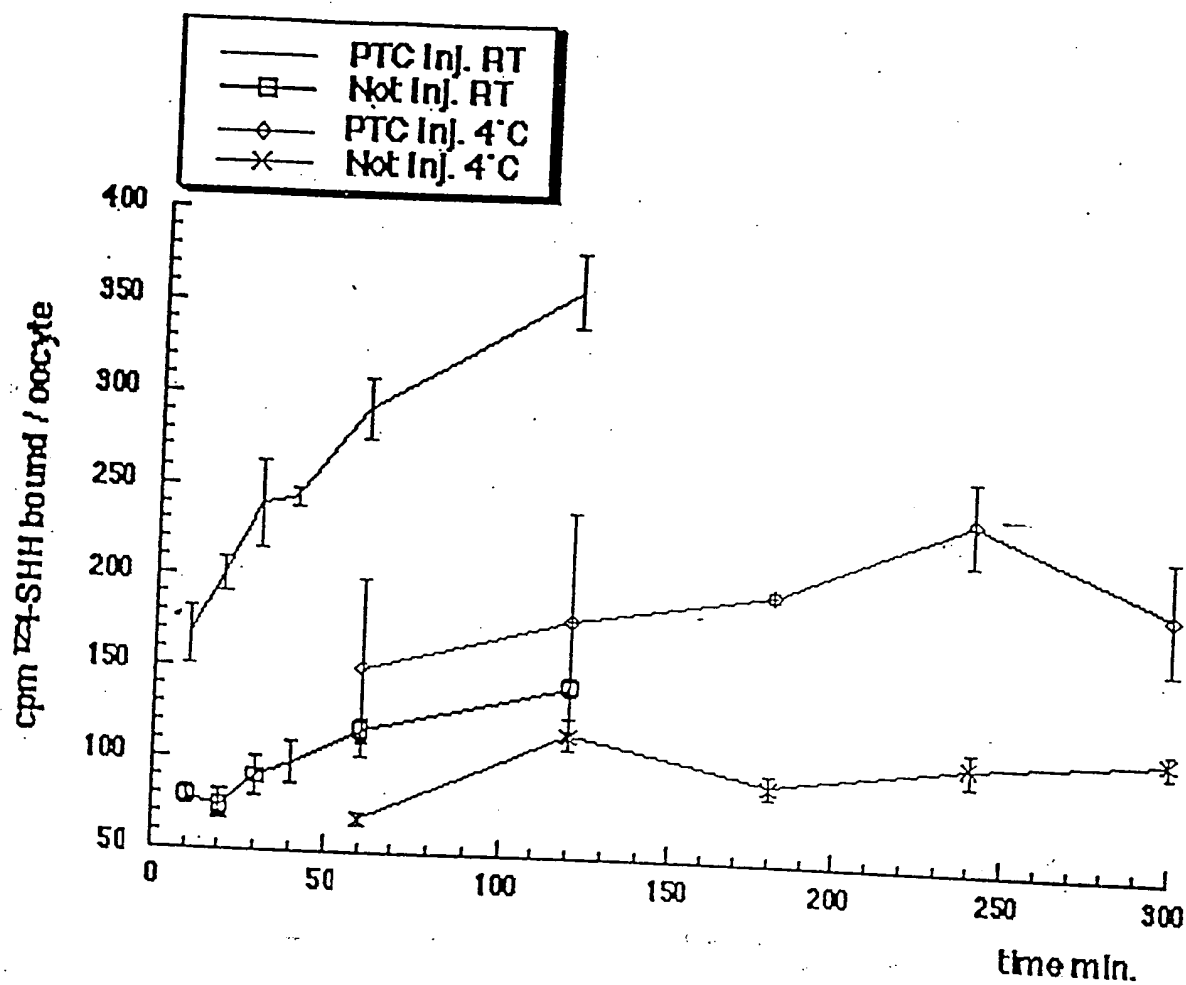


FIGURE 19

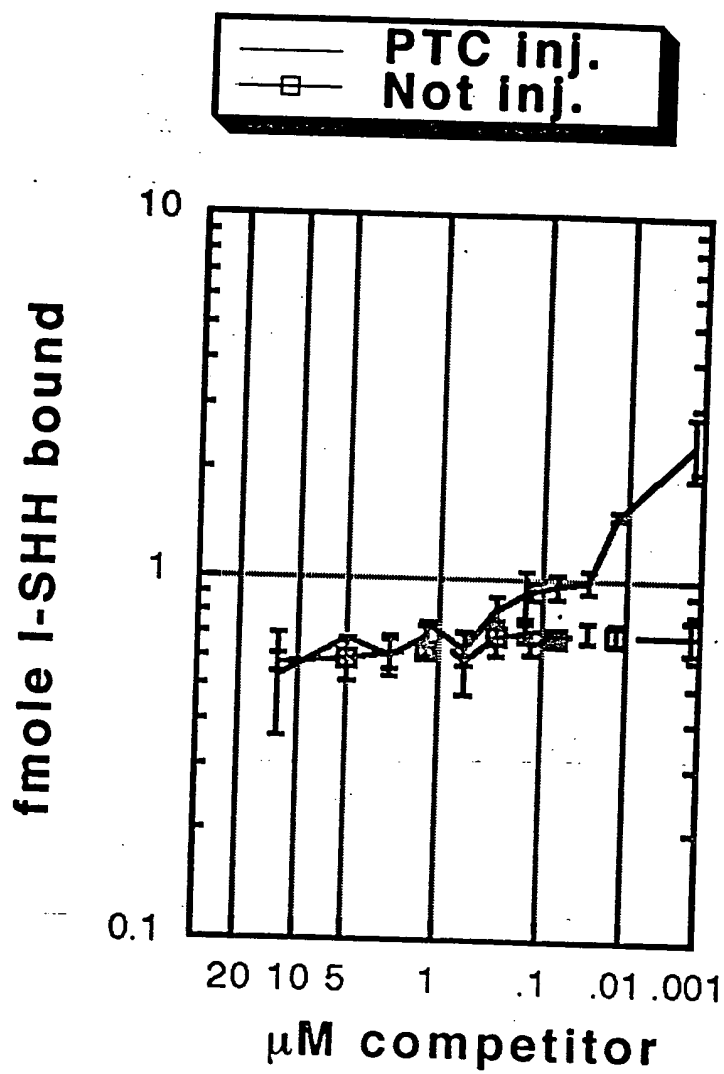


FIGURE 20

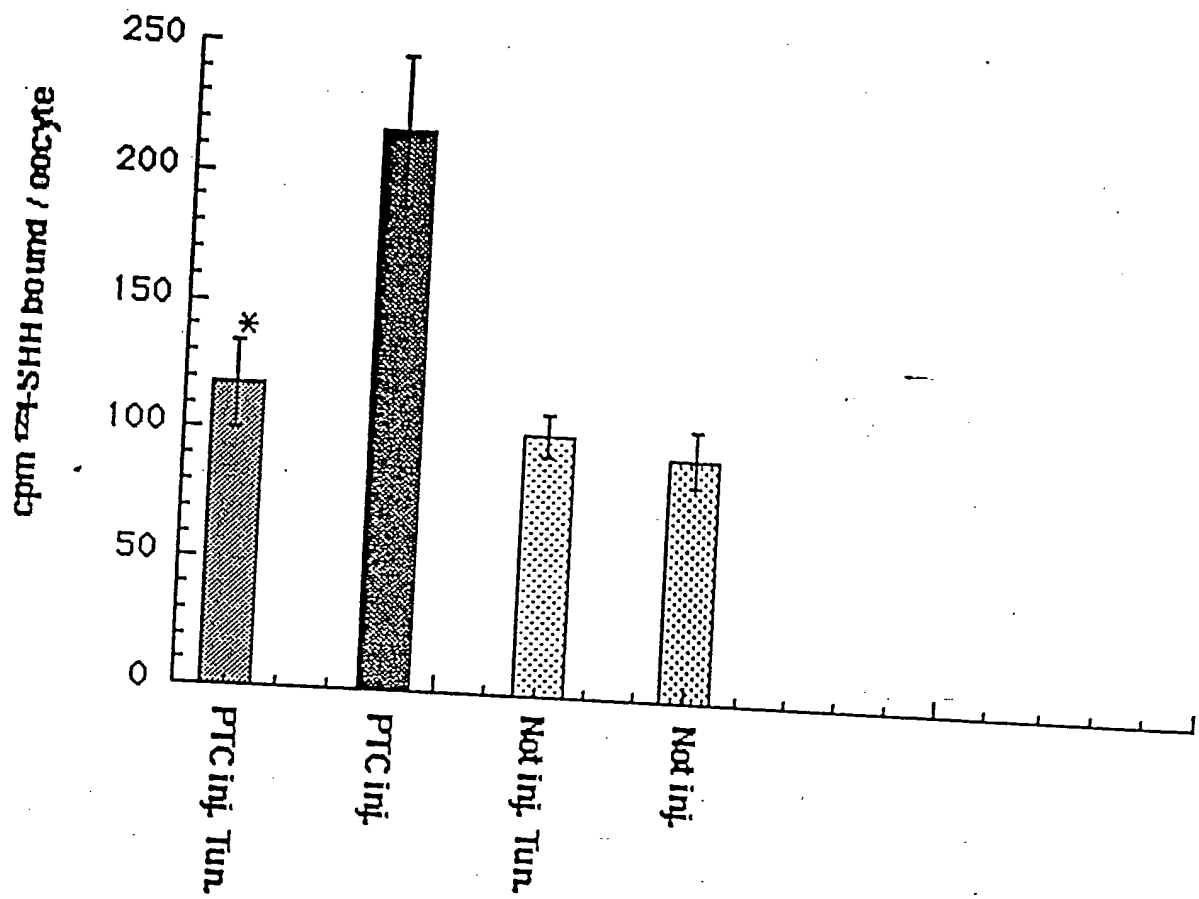


FIGURE 21

Figure 8. A possible topological model of the mouse Ptc protein. The mouse Ptc protein is proposed to have 12 TM domains and two glycosylated extracellular hydrophilic loops. Black and lightly shaded circles indicate identical and similar amino acids, respectively, shared between the mouse and fly Ptc proteins.

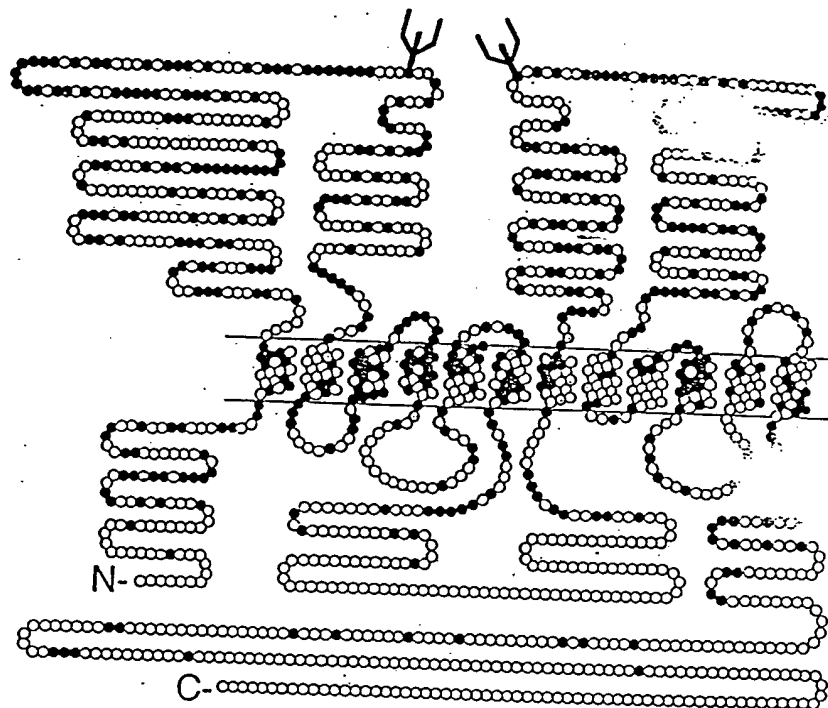


FIGURE 22